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EDITORIAL

The Dwarf Coconut Palm.

In the year 1919 Mr. W. P. Handover contributed an article to the Agricultural Bulletin F.M.S. (Vol. vii., No. 5) on the dwarf coconut palm (*nyior gading*). In the article he stated that this type of palm probably first originated as a "sport" or mutant in Java and was later introduced into this country. In the year 1912 dwarf palms were first planted under estate conditions in Negri Sembilan where an area of 500 acres was planted from seed nuts obtained from dwarf palms grown by Malays on the rice fields of the Krian district. Considerable interest in the cultivation of this type of palm was aroused and a number of coconut estates planted up areas with dwarf palms in subsequent years.

Two Articles have been published in the Malayan Agricultural Journal (Vol. x., 1922, and Vol. xvii., 1929) giving information regarding the three varieties of dwarf coconuts grown in this country. It was shewn that the palms —particularly the "green" variety—gave good returns provided that the growth conditions were favourable and that the palms were given fair treatment.

In this issue of the Journal an account is given of further investigations carried out on estates and on the Government Coconut Experiment Station, Klang, on the growth and yield of dwarf palms and on the quality of the copra they produce. The account indicates that these palms appear to be very sensitive to unfavourable conditions resulting in poor growth and a falling off in yield, and also that the cost of production of the copra is somewhat higher than in the case of tall palms. Furthermore it is mentioned that, even if special care is taken in the manufacture of copra from dwarf palms, none of the varieties yield a product equal in quality to that obtainable from tall palms growing under similar conditions.

This information reveals certain drawbacks which tend to counter-balance the main advantage offered by dwarf palms of giving a return after five years compared with a period of eight years in the case of tall palms.

Lowland Tea in Malaya.

The article by J. N. Milsum, Acting Agriculturist and T. D. Marsh, Assistant Agriculturist, which is included in the present number under the title of "Lowland Tea in

Malaya", records the result of experiments in cultivation and manufacture of black tea on 36 acres of land on the Government Experimental Plantation, Serdang.

The area under this crop is situated on soil of average fertility at an elevation of 175 feet above sea level, and the results achieved demonstrate the fact that lowland tea can be grown successfully and high yields be obtained in this country. Black tea has been manufactured at the Serdang factory for the past two years and has found a ready local sale.

Samples of the product have been submitted to firms in London and Ceylon who have reported satisfactorily upon them.

The figures of imports of tea into Malaya from different countries during the year 1931 are illuminating in that they show that the quantity of China tea as compared with black tea is in the ratio of approximately 2.5 to 1.

The import statistics for 1932 so far available indicate that as a rough approximation, based on the assumption that the ratio of imports of China and black tea were the same as in 1931, production from 6,500 acres of China tea and 2,000 acres of black tea would satisfy local consumption.

At the end of 1932 the area under tea in Malaya amounted to 2,645 acres, of which 1,996 acres were planted in the lowlands and 649 acres at high elevations. It will be seen, therefore, that although room for expansion of black tea production for the local market is limited, there remains a comparatively wide opening for the cultivation of tea which will fulfil the requirements of the Chinese population.

The production of China and green tea is now receiving attention at the Government Experimental Plantation, Serdang, but so far only limited results have been obtained. It is evident that further investigation on this subject will be of great value.

As regards the development of export of tea, enquiries have recently been received from Australia into the possibilities of the importing of Malayan lowland tea: these possibilities are now being investigated.

Packing and Transport of Palm Oil.

The high cost of packing and transport of Palm oil has hitherto formed a serious handicap to the industry in Malaya. With the market price standing at the low figure of about £14 per ton, the difference between the cost of production and the market price is so small that the factor of transport is a matter of vital importance. Whereas for some years past this product has been shipped from Africa and Sumatra in specially constructed tank vessels, Malayan palm oil has, until recently, been exported in barrels, the materials for which were imported from America.

It is estimated that in the year 1931 the cost of barrels amounted to approximately $200,000.

Efforts to manufacture barrels from local timbers have met with some

measure of success but since the annual production of Malayan palm oil now amounts to over 7,000 tons, the provision of measures for bulk shipments are justified.

The principal difficulty attached to the transport of this commodity in bulk has been its transference from the estate to the port of shipment. The provision of tank waggons which has already been made on the F.M.S. Railways and the construction of a tank lighter, which will shortly be completed by a local shipping firm for the conveyance of palm oil from estates situated on or near the Selangor and Bernam rivers, will do much towards solving the transport problems of this industry.

Publications of the Empire Marketing Board.

It is considered desireable that attention should be drawn to the publications which are issued periodically by the Empire Marketing Board. These monographs, of which 61 have been published on general agricultural and allied subjects, 23 on production and trade of the Dominions and Colonies, and 5 as a series of commodity reports, are of great value in the dissemination of results of up to date agricultural and statistical research within the Empire.

An abstract of the Empire Marketing Board's handbook No. 61 entitled "Survey of Oilseeds and Vegetable Oils" Volume II "Coconut Palm Products" was included in the March number of this Journal, while among others which may be recommended as being of special interest in this country are E.M.B.1 "Agricultural Economics in the Empire": E.M.B.2 "Tropical Agricultural Research in the Empire": E.M.B.54 "Survey of Vegetable Oilseeds and Oils" Vol. I "Oil Palm Products": E.M.B./T.P.23 "The Production and Trade of British Malaya" and E.M.B./C.4 and C.5, Commodity Reports on "Oilseeds and Vegetable Oils"* and "Plantation Crops"† respectively.

The above publications are obtainable from the Sales Office of His Majesty's Stationery Office, Kingsway, London, at prices ranging from 3d. to 2/6s. including postage.

Departmental Circulars.

Attention is invited to the recently published circulars of the Department of Agriculture, S.S. and F.M.S., nos. 3 of 1932 and 4 of 1933 upon the subject of "The Cultivation of Allotments by Tamil Labourers" (also published in the Tamil language) and "Wet Rice Cultivation". These circulars are primarily designed to assist in estate managers and others improving the conditions of the growing of food crops by labour forces, and are available from either the Department of Agriculture, Kuala Lumpur, or from the Labour Office, Kuala Lumpur.

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*This publication was reviewed in the *Malayan Agricultural Journal*, Vol. XXI, No. 2 of February 1933.

†Reviewed in the *Malayan Agricultural Journal*, Vol. XXI, No. 3, March 1933.

Original Articles.

LOWLAND TEA IN MALAYA.

BY

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and

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Introductory.

It is proposed in the following article to record the results obtained with the cultivation and manufacture of tea at the Government Experimental Plantation, Serdang, and to review the prospects of lowland tea production in Malaya. With regard to manufacture, efforts have been so far directed mainly to the production of black tea. As will be shown later, however, the greatest opportunity for extension of the local tea industry appears to lie in the manufacture of China and unfermented teas.

The original planting programme at Serdang set aside an area of 15 acres for tea. The first consignment of tea seed was received from India during December, 1924. Details of early experiments with this crop have already been made public in Departmental publications (1) and (2).

Whilst it is known that tea is a sub-tropical plant and is best suited for cultivation at high elevations in the tropics, yet experience proves that black tea of very satisfactory quality may be produced on the plains in this country. A fairly wide range of imported Indian "jats" (varieties) together with seed from estates in Ceylon and a Chinese variety, have all made consistently good growth and yielded satisfactorily under local conditions.

It is of course generally known, that at the present time there is considerable over-production of tea compared with the existing world demands, and a scheme, designed to restrict production in certain countries, is under discussion. On the other hand the consumption of tea locally is considerable, and, with a return to more normal conditions of prosperity, it will certainly increase. Furthermore, it is to be noted that recently duties have been placed on tea imported into the Federated Malay States and other States in Malaya.

It is considered unnecessary to deal with the general principles of tea cultivation and manufacture since information on this subject was published recently by the Department of Agriculture in the form of a Special Bulletin (3). An article on the cultivation and manufacture of tea in mid-country districts in Ceylon was also published (4).

Imports.

Imports of tea into Malaya for the period 1929—1932, compiled from official returns, are shown in the following table :—

TABLE I.

Net imports of Tea into Malaya period 1929 - 1932.

Year.	Quantity. lbs.	Value. $
1929	10,152,422	3,885,275
1930	8,732,453	2,872,220
1931	6,848,642	1,667,931
1932	4,445,213	1,016,492

Import Duties.—The following duties on tea imported into the Federated Malay States have been imposed by the Federated Malay States Government, see Notification No. 8043 of 28th October, 1932 :—F.M.S. Government Gazette,

Tea, per pound, full duty 8 cents,
preferential duty, 6 cents.

The following table shows the quantities of tea imported into Malaya from different countries during the year 1931 :—

TABLE II.

Countries of origin.	Quantity of tea imported. lbs.	Total value. $	Average value per lb. cts.
China ...	5,051,601	1,065,149	21
Ceylon ...	1,036,779	513,441	50
Java ...	757,723	142,484	19
British India ...	285,479	119,224	42
Hong Kong ...	196,486	40,662	21
Japan ...	107,833	22,924	21
Sumatra ...	65,549	12,558	19
United Kingdom ...	6,934	6,093	88
Siam ...	5,712	1,415	25
Burma ...	850	187	22
Sarawak ...	750	450	60
B.N. Borneo ...	320	60	19
Philippine Islands and Subu ...	35	60	171

The above Table is included since it records in detail the countries of origin of the tea imported into Malaya. Import figures for the year 1932 which have but recently become available show a considerable reduction as compared with these figures—c.f. Table I.

It will be seen from Table II that the imports of China tea as compared with black tea are in the ratio of approximately $2\frac{1}{2}$ to 1. The figures indicate that the product from some 10,000 and 3,000 acres respectively would meet the consumption requirements of Malaya for green and black tea for the year 1931. It is not possible as yet to compute the acreages necessary to satisfy present consumption requirements, as indicated by the imports for 1932, but it is estimated that the acreages mentioned above might, however, be reduced by one-third.

Unless, therefore, it is proposed to produce tea suitable for the Chinese population, there is little room for further planting of tea other than for export. Thus it may be stated, that whilst expansion of black tea production for local use is limited, there remains a comparatively wide opening for the cultivation of Chinese tea or unfermented tea agreeable to a large proportion of the Asiatic population.

Area Under Cultivation.

In Table III, the total acreage of tea planted in Malaya up to the end of 1932 is shown.

TABLE III.

Acreage of Tea under Cultivation in Malaya, 1932.

State or Territory.	Area in acres.
Perak ...	115
Selangor ...	809
Negri Sembilan ...	16
Pahang ...	703 (x)
Total F.M.S. ...	1,643
Malacca ...	15
Dindings ...	1
Total S.S. ...	16
Kedah ...	986
Total U.M.S. ...	986
Total Malaya ...	2,645

(x) 649 acres of which is upland tea.

Cultivation at the Government Experimental Plantation, Serdang.

Planting operations commenced in 1925, when some five acres were established. At the close of 1932, a total of 36 acres was planted, including 23 acres in bearing.

The following is a complete list of the "jats" planted :—

Jat.	Type.	Remarks.
Dangri	Manipuri	A large dark-leafed jat originally from the Manipuri Hills.
Dhonjan	Assam	A large dark-leafed indigenous Assam jat.
Rajghur	Hybrid	A vigorous hybrid between Assam and Manipuri jats.
Betjan	Assam	A large light-leafed indigenous Assam jat.
Markong	Manipuri	A large dark-leafed Manipuri jat.
Taikong	Assam	A pure indigenous dark-leafed Assam jat.
Kirrimittia	Manipuri	A dark-leafed Manipuri jat from Ceylon.
Bogawantalawa	Assam	A light-leafed Assam jat from Ceylon.
Mahawella	Manipuri	A dark-leafed Manipuri jat from Ceylon.
China	China	Seed obtained locally from Chinese holdings.

Climate.—The rainfall at Serdang shows the seasonal variation common to most of the interior of the Malay Peninsula with wet seasons during March—April and part of May and also October—December. A fairly long dry season occurs from the middle of June to the middle of September and a shorter dry season in January and February. Consequently the best months for planting are March—April and October—November. Flushing of new growth from the bushes is vigorous almost all the year, necessitating a seven-day plucking round,

except during the month of August, when an 8 to 9 day interval between plucking is found sufficient.

Soils.—The soils of the tea areas at the Experimental Plantation, Serdang, are composed of dark sandy to yellowish clay-loam belonging to the quartzite type, commonly met with in inland districts of Selangor. A full description of the soil is contained in the Guide to the Government Experimental Plantation, Serdang (2). The mean elevation of the plantation is approximately 175 feet above sea-level.

Nurseries.—In raising tea seedlings, two factors have been found essential under local conditions namely shade and a free rooting medium. Seeds may be either sown in sand beds under shade and transplanted, or sown in well cultivated beds dug to a depth of 18 inches and shaded with ataps. The best germination results have been obtained from sand beds. Up to the present propagation has been entirely from seed. Recently encouraging results have been obtained at Serdang from etiolated shoots, but no experience is so far available to show whether such rooted shoots would give satisfactory results in the field.

Planting.—The "jats" Dangri, Dhonjan, Rajghur and Betjan planted 4 feet by 4 feet square, in Block 3, indicate that the planting distance might be somewhat closer. The bushes, pruned at intervals of two years, do not actually meet in the rows, except in the ravines where the soil is above average fertility. To obtain more exact information on this point, a planting distance experiment with Dangri "jat", planted in May, 1929, in Block 16 is under observation. The area of the block is 9 acres and this is divided into three 3-acre plots with the following planting distances :—

Plot.	*Planting Distance.*	*Bushes per acre.*
1	4 feet x 4 feet.	2,720
2	4 feet x 3½ feet.	3,111
3	4 feet x 3 feet.	3,630.

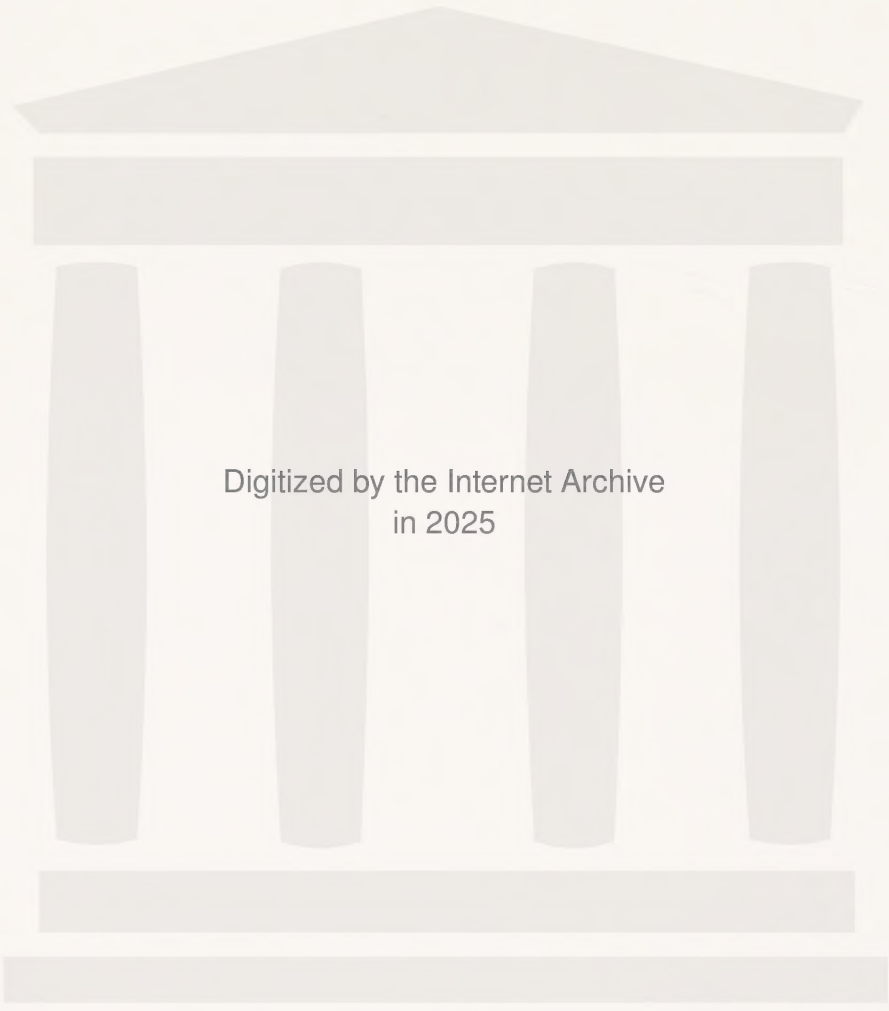
Plucking commenced in May, 1932, *i.e.* three years after planting. It will be sometime, however, before definite results will be forthcoming from this experiment.

With regard to planting, it has been found that good sized stumps up to two years old, are far easier to establish than seedlings of younger ages. Furthermore, the care required in handling and planting is considerably less with stumps than with younger seedlings. Old stumps, devoid of soil, root readily, whilst young seedlings, even with a ball of soil round their roots, fail to become established in a large number of instances.

Leguminous Shade Trees.—The most successful shade tree that has been tried at Serdang is *Albizzia moluccana;* this gives the ideal high feathery shade so desirable for lowland tea. This tree has attained a height of 50 feet in three years from planting, the nursery seedlings being about three months old when transplanted. The trees should be widely spaced, a final stand of 80 feet by 40 feet apart is suitable; if planted closer a considerable amount of thinning out becomes necessary. *Albizzia moluccana,* has however, two defects. The wood

FIGURE 1
Manipuri Tea Seedlings, one year old at Government Plantation, Serdang.

FIGURE 2
Manipuri Tea, four years old, recently pruned, on same area as in Fig. 1, showing rapid growth of *Albizzia moluccana*.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is soft and in exposed situations the branches and often the trunk are liable to be broken by high winds. This defect can, to some extent, be minimised by planting a belt of suitable trees to act as wind breaks. For this purpose *Grevillea robusta* has proved fairly satisfactory, although growth is not so vigorous on the plains as at higher elevations. Another defect is that *Albizzia moluccana* is liable to suffer from considerable defoliation by caterpillars of a small yellow butterfly (*Terias hecabe*), during certain periods of the year. An outbreak occurred at Serdang towards the end of 1932, when migration of the caterpillars from the Albizzia to tea bushes in the near vicinity resulted in the latter being seriously attacked.

Two other species of Albizzia namely *A. fastigata* and *A. stipulata* are under trial but have proved unsatisfactory.

Gliricidia maculata, although a considerably smaller tree than the former, has proved a satisfactory shade tree and green manure. It is particularly suitable for exposed situations. The usual planting distance is about 15 to 20 feet apart. A large amount of green foliage is produced and, when periodically pruned, provides a valuable supply of green matter for the soil. It does not, however, give the high feathery shade as does *Albizzia moluccana.* Gliricidia is readily propagated from stem cuttings which should be 10 feet long and one inch in diameter.

Erythrina lithosperma, "dadap", which is commonly used as a green manure tree on mid-country estates in Ceylon, is almost invariably attacked under Serdang conditions by a large borer caterpillar (*Terastria meticulosalis*). From results shown to date it is not recommended to plant this tree extensively. It might, however, prove more successful on better land where vigorous growth would combat the damage done by borer caterpillars.

Cover Crops and Green Manures.—The most satisfactory of the taller leguminous plants under trial have proved to be *Crotalaria anagyroides, C. usaramoensis,* and *Tephrosia candida.* These plants make excellent auxiliary shade for young tea, if allowed to grow tall: they may be pruned periodically. By this means the surface soil is kept cool and erosion is prevented. A tea estate on virgin land on the lowlands in Malaya has been maintained in a clean condition and brought to the plucking stage at a very low cost by the intensive use of *Crotalaria anagyroides.*

After the tea bushes are pruned preparatory to plucking, the green manures should be periodically cut back to a height of about two feet and the prunings returned to the land. It is, of course, too costly an operation to bury all such prunings in the soil, since the plants require pruning at intervals of three months or so. The only practical method is to spread the prunings on the surface and gradually incorporate them with the soil during weeding operations.

Experiments designed to ascertain the quantities of green matter produced from typical leguminous plants have been carried out at the Experimental Plantation, Serdang, with the results shown below. The green manures were sown between every second row of tea.

Prunings from Green Manures.

Green Manures.	Period between prunings.	Wt. of green matter per acre per annum. lbs.	Calculated dry matter. lbs.
Crotalaria anagyroides	2 months	18,870	4,715
Crotalaria usaramoensis	2 months	11,350	2,837

The life of the green manure plants is only 2½ to 4 years under ordinary conditions and unless natural seeding takes place or resowing is undertaken, other forms of soil conservation become necessary. This has been accomplished by the use of low-growing leguminous cover plants. The most successful cover crop tried at Serdang is *Indigofera endecaphylla.* This plant forms a low-growing matted cover over the ground and, what is more important, it does not climb into the tea bushes. Another plant that shows promising results is *Desmodium heterophyllum.*

When the tea bushes have become sufficiently large to cover the land the use of cover plants becomes less necessary, especially where loss of surface soil from erosion is not excessive. To establish a good stand of cover plants or green manures, the practice at Serdang is to mix a small quantity of a basic phosphatic fertiliser with the seed and sow seed and fertiliser together. Basic slag mixed with the seed at the rate of ½ cwt. per acre is employed. The mixture of seed and fertiliser is sown in drills between each row of tea in the case of low covers, and between alternate rows when establishing tall-growing green manures.

Soil Conservation.—A considerable number of experiments are in progress at the Government Plantation, Serdang, with a view to obtaining information regarding this important subject. Whilst on the highlands of Malaya severe damage from soil erosion in tea areas has not been found to occur, the reverse is the case in the lowlands. It is important, therefore, that adequate preventive measures against soil erosion should be taken from the commencement of opening the land. As already mentioned, an excellent preventive against soil erosion in the early stages of growth is the employment of tall-growing leguminous plants which protect the soil from downpours of rain. The most satisfactory measure against soil erosion has been found to consist of a combination of contour silt pits, with a leguminous plant or strong-rooting grass, planted upon the bund in the form of a hedge. For this purpose *Crotalaria anagyroides, Clitoria cajanifolia* and Vetiver grass, *Vetiveria odorata,* have been successfully employed.

On moderately undulating land contour silt pits, 30 feet long by 2 feet deep and 2 feet wide, with stops two feet wide between the ends of the pits, have

been used with success. The distance between each row of contour pits should average half a chain. Vetiver grass has a vigorous root system which conserves the bunds. It is necessary to plant the root cuttings closely, not more than 4 inches apart. The grass is cut back periodically and the green matter returned to the land. *Clitoria cajanifolia* may be used in a similar manner and since it is a deep rooting legume it forms an excellent hedge plant on hill sides. On steep land contour terracing has been undertaken at the Experimental Plantation, Serdang, on a small area in Block 3 for the purpose of comparing the relative merits of these two systems of soil conservation. There does not appear to be any necessity for terracing unless the land is very steep. *Tephrosia candida* and Vetiver grass are planted on the edges of the terraces to assist in holding up the soil. The cost of terracing land for tea is comparatively expensive and for this reason is not recommended unless other forms of soil conservation are considered ineffective.

Manuring.—With a crop such as tea, where a large amount of the plants' growth is removed at short intervals, it is obvious that frequent manuring is necessary and such has proved to be the case at the Experimental Plantation, Serdang. Up to the present, the somewhat complicated and expensive manurial mixtures outlined below have been employed.

Block 3. Pruning Mixture.—This area was planted in 1925 on virgin land, it was first manured after pruning in October, 1930. The following mixture was applied by the process of "envelope" forking :—

150 lbs.	Whale guano compound
50 ,,	Sulphate of ammonia
50 ,,	Nitrate of soda
150 ,,	Superphosphate
50 ,,	Sulphate of potash
450 lbs.	per acre.

The growth and yields during the past two years have been excellent and the bushes have undoubtedly derived great benefit from the application of fertilisers.

Block 15 and 16, planted during 1929, on land that had grown crops previously, showed slow growth and received a new clearing mixture as detailed below :—

Block 15 and 16. New Clearing Mixture.—

50 lbs.	Whale guano compound
50 ,,	Sulphate of ammonia
150 ,,	Superphosphate
50 ,,	Sulphate of potash
300 lbs.	per acre.

For the purpose of obtaining information as to the relative values of organic and inorganic fertilisers the following manurial experiment has been laid down on a small area of tea in Block 15, planted November, 1929.

The fertilisers applied comprise :—

(*a*) An acid mixture
(*b*) A basic mixture
(*c*) General organic mixture
(*d*) Control (no manure).

It is proposed to extend this experiment over a larger area when preliminary results have been obtained.

Pruning.—Lowland tea in Malaya arrives at the plucking stage in about three years after planting in the field. This period varies somewhat according to (*a*) the size and age of planted stumps (*b*) fertility of the soil, (*c*) treatment of bushes from planting to plucking. The tea bush is best able to withstand the severe shock of pruning when growth is active and starch reserves are high. The starch content of the bushes is raised by cessation of plucking for a few weeks before pruning. The most satisfactory time for pruning has proved to be the latter part of October and all pruning at Serdang is now undertaken during this month. Pruning of the tea bush is an important undertaking and fully satisfactory results can only be obtained with practice and experience. The general principles of tea pruning are described in the Special Bulletin on tea cultivation (3) pages 28—35.

Experience at Serdang demonstrates that when tea is planted on land that has grown a previous crop and become impoverished, considerable damage may result from the attacks of termites. The cause of these attacks is due to the pruned branches dying back owing to lack of vigour of the bushes, thus affording entry to the termites. By planting on virgin land and maintaining vigorous growth of the bushes by manuring, little or no damage from termites is likely to occur. Control measured against termite attack of tea bushes on impoverished land at Serdang are now being investigated by the Government Entomologist.

Plucking.—It has been found at Serdang that a weekly round of plucking is satisfactory for about eleven months of the year, the month of August with the lowest rainfall, requiring an interval of eight or nine days between the plucking rounds. This operation requires a considerable amount of supervision at the start to ensure satisfactory results from the inexperienced labour usually available.

The system of plucking undertaken may be termed "fine" since two leaves and the bud only are plucked. Soft "banji" is included in the leaf for manufacture; hard "banji" is plucked and discarded. It should perhaps be mentioned that the leaves are of two distinct types—ordinary and "banji"; the latter is a leaf with a stunted bud which generally makes no further growth.

China tea.—The statistics quoted at the commencement of this article show the large amount of China tea imported into Malaya. The production of tea of this type and of green tea is receiving attention at the Government Plantation,

Serdang, but so far only preliminary results have been obtained. It is evident that the production of teas suited to the requirements of the Chinese population warrants extended investigation.

It should be mentioned here that the manufacture of green tea as distinguished from black, differs in that the former does not undergo any process of fermentation, while the comparatively slow operation of withering is replaced by the rapid one of steaming. Certain teas known as "oolong" teas are manufactured by a process halfway between that of green and black tea. The leaf is slightly withered and lightly fermented before the tea is dried.

With regard to yields the one-acre plot of China tea planted in Block 3 during November, 1926, gave a crop of 480 lbs. of made tea for the full cropping year ending October, 1932.

Some China tea is grown on the lowlands in Malaya, particularly in the Cheras district of Selangor. A description of these areas and the methods employed in the cultivation and manufacture by Chinese has already been published (5).

Yields.—In Table IV the yields of leaf and calculated yields of made tea from four one-acre plots of mature tea in Block 3 are recorded. This area was planted early in 1925 and reached the plucking stage on the 12th October, 1928. Plucking has been carried out continuously since that date with the exception of a three month's rest after pruning which was undertaken in October, 1930. All vacancies have been supplied and a proportion of these supplies have now been brought into the plucking round.

Yields from Blocks 15 and 16 where plucking commenced in May, 1932, are being recorded but are as yet of insufficient value to be worth publishing.

Insufficient evidence is as yet available to enable a pronouncement to be made as to which "jats" are the most suitable for cultivation on the lowlands of Malaya. All four "jats" referred to in Table IV have made good growth, flushed well, and given satisfactory yields.

Manufacture.

The following description of manufacture refers solely to black tea which has so far only been produced for sale at Serdang. The reports on samples submitted to London and Colombo also refer to black tea.

Tea Factory at the Experimental Plantation, Serdang.

The tea factory commenced operation during July, 1931. It is a permanent type of building, based on a modern Ceylon design, 60 feet long and 40 feet wide. Rolling, fermenting, firing and sifting rooms are on the ground floor and a withering loft above.

The withering loft contains five series of "tats" each complete "tat" being 33 feet long by 7½ feet wide, with seventeen layers of hessian cloth, providing

TABLE IV.

Yields of Leaf and Made Tea from 12th October, 1928 to 11th October, 1932.

Jat.	Period.	No. of bushes plucked.	Percentage actual to possible bushes.	Weight of leaf plucked lbs.	Yield of Tea per plot. lbs.	Remarks.
Dangri	Oct. 28 — Oct. 29	2,249	82.6	2,452	613	
	29 — 30	2,229	81.8	2,845	714	
	30 — 31	2,102	77.2	2,169	542	9 months plucking.
	31 — 32	2,395	88.0	4,340	1,085	
Dhonjan	28 — 29	1,749	64.4	2,079	520	
	29 — 30	1,740	63.9	2,616	654	
	30 — 31	1,826	67.1	1,829	457	9 months plucking.
	31 — 32	1,983	72.9	4,056	1,014	
Rajghur	28 — 29	2,198	80.7	1,792	448	
	29 — 30	2,190	80.5	2,413	603	
	30 — 31	2,170	79.7	2,003	500	9 months plucking.
	31 — 32	2,005	70.7	3,851	963	
Betjan	28 — 29	1,313	49.7	1,870	467	
	29 — 30	1,300	47.8	2,303	575	
	30 — 31	1,856	68.2	1,850	462	9 months plucking.
	31 — 32	2,071	76.1	3,733	944	

FIGURE 3
Young Tea on terraced land with hedges of *Tephrosia candida*.

FIGURE 4
Tea Factory at Government Plantation, Serdang.

a total withering space of 21,037 square feet, capable of holding 1,500 to 2,000 lbs. of green leaf per wither according to density of spread. Two 36 inch exhaust fans are installed in the withering loft. At the opposite end of the loft is an air bulking chamber which extends to the full width of the building. Hot air is drawn from the tea dryer and expelled into the loft, when artificial withering is necessary, by controllable vertical palisades which give any degree of opening desired.

The machinery installed comprises the following. Two "Little Giant" tea rollers, each having a capacity of 60 lbs. of withered leaf per charge. An improved tea roll-breaker fitted with beating apparatus and sieves. A 42 inch "Venetian" tea drying machine with a firing capacity of 45 to 50 lbs. of made tea per hour. The sifter installed is of an improved pattern, with three trays, 7 feet long, the brass wire sieves of which are 8, 10, 12 and 24 wires to the linear inch. There is also a 24 inch exhaust fan operated near the tea sifter, and a single cylinder tea cutter fitted with $\frac{3}{8}$ inch cells. The machinery is driven by a 13 B.H.P. electric motor, working at 580 revolutions per minute.

Withering.—The leaf from the field is sorted and all hard "banji", stalk and over matured leaf is discarded. This is done to reduce the quantity of red leaf, stalk and fibre in the finished product.

The leaf is spread on the "tats" at the rate of 1 pound to 10 to 14 square feet of hessian. The rate of spreading is varied according to the atmospheric humidity, when it is high the larger area on the "tat" is used, so that a natural wither can be obtained within the reasonable time of 18 to 24 hours. Hygrometers are used to indicate the humidity of the atmosphere and when readings are recorded showing a difference between the wet and dry bulbs of 4 degrees or less, artificial withering is employed. Artificial withering consists of the use of hot air mixed with atmospheric air so that the relative humidity of the mixed air is lowered and thus becomes capable of taking up moisture from the withering leaf. The leaf is withered until it is reduced in weight by loss of moisture to 55—60 per cent. of that of the fresh leaf. In practice, appearance and smell serve as a guide to correct withering.

Rolling.—The speed of the two "Little Giant" rollers is from 55 to 58 revolutions per minute, each roller taking 60 lbs. of withered leaf per charge. The rolling programme for general use is as follows :—

First rolling 30 minutes, no pressure.
Second rolling 45 minutes, light pressure (the weight is applied for 5 minutes and off for 5 minutes).
Third rolling 45 minutes, more pressure than the second rolling (the weight is applied for 5 minutes and off for 5 minutes).
Fourth rolling 30 minutes, more pressure than the third (the weight is applied for 5 minutes and off for 5 minutes).

Fermentation.—The leaf tips or "dhool" that pass through the sieve of the roll-breaker after each period of rolling are allowed to ferment in separate lots for a period of about $2\frac{1}{2}$ hours. Later "dhool" and the final bulk require a shorter period of fermentation. The operation is carried out on two tiered

tables, constructed on an iron framework, with smooth concrete fermenting surface. The fermenting leaf is placed on the tables to a standard depth of 1½ inches. Coolness and high atmospheric humidity are provided during fermentation by means of an air current over dripping water.

Firing.—The tea at Serdang is dried at a maximum temperature varying between 195°F and 200°F, at the air inlet, the exhaust temperature of the air varying between 120°F and 130°F. These temperatures are controlled by (1) the rate of stoking, (2) the damper at the foot of the Tea Dryer, and (3) the speed of the exhaust fan. The time taken to pass the "dhool" through the dryer is 30 minutes, the bulk tea requiring a little longer. The capacity of the "Venetian" Tea Dryer installed is about 40 lbs. of made tea per hour.

Grading.—The "dhool" and bulk tea are graded on the sifter in the ordinary way. The following are lists of the various grades of tea manufactured at Serdang:

(*a*) average percentage grades for period June—December, 1932.

(*b*) maximum recovery of higher grades.

		(*a*)	(*b*)
Broken Orange Pekoe	...	38.94 per cent.	51.85 per cent.
Broken Pekoe	...	17.17 ,,	9.72 ,,
Pekoe	...	20.83 ,,	23.15 ,,
Fannings	...	16.06 ,,	10.65 ,,
Dust	...	7.00 ,,	4.63 ,,
		100.00 per cent.	100.00 per cent.

Marketing.—All tea manufactured at Serdang has been sold locally up to the present. The tea is marketed in soldered and sealed lead packets with a covering label. It is found that 2½ ounce lead sheets are sufficiently strong for packets weighing not more than one pound. The tea is despatched to the distributors in paper-lined wooden cases, each containing 50 lbs. of tea, made to accommodate either ¼, ½ or 1 lb. packets.

The tea manufactured has been sold in packets to the distributing agents at the following wholesale prices:—

Broken Orange Pekoe	...	...	60 cts. per lb.
Orange Pekoe	...	...	50 cts. ,,
Fannings	...	...	40 cts. ,,
Dust	...	...	25 cts. ,,

These teas have been retailed throughout Malaya during 1932 at 10 to 15 cts. above the wholesale prices. In spite of the import tax, prices of imported tea have fallen recently and the above prices have now been lowered to meet competition from outside sources.

Reports and Valuations.

The reports on two samples of tea grown and manufactured at the Experi-

mental Plantation, Serdang are given below. It will be seen that the tea is favourably commented upon, although there is some room for improvement.

The third report is on a sample of tea grown on an estate in the lowlands and manufactured at Serdang. The sample represents the first plucking from young bushes.

The Department of Agriculture is always ready to undertake the manufacture of small breaks of tea from local estates for the purpose of obtaining early reports upon their quality and valuation.

(1) Report by Messrs. Shepard & Co., London, dated 12-10-31.

Leaf—Leaf is a well made but rather mixed Orange Pekoe with a little tip. Contains some small leaf but we should say might be suitable for continental trade.

Infused leaf—is a good even colour.

Liquor—Liquor has good strength and colour and "creams," fairly well. It is rather lacking in point and flavour. We value this tea about 1/0d. per lb. on to-day's (12th October, 1931) London market.

The general style of manufacture is distinctly good and the tea is somewhat similar in type to an ordinary Assam Orange Pekoe. The tea, however, is not of a kind to realize a big price on the London market. The leaf contains too much twist to be in demand for Home blenders while it is rather mixed from the export point of view. From the colour of infused leaf and cup character, however, we should say the tea has distinct possibilities.

If it were decided to sell in London it would be advisable to make the leaf smaller and more even, with a brisker liquor. We are sending two samples of Assam Broken Orange Pekoe and Broken Pekoe (two grades into which your tea could be sorted) now selling in London at good prices and which we think your tea would be capable of imitating."

Corresponding prices in London were Assam 1/5¾d. per lbs., Cachar and Sylhet 8½d. per lb.

Reports from London received this year (1933) value the Broken Orange Pekoe grade at 8½ pence to 1/- per lb., and 7—8 pence per lb. for the lower grades. One report made special mention of the quantity of tip present for low grown tea.

(2) Report by Messrs. Keell & Waldock, Colombo, dated 15-3-32.

"Grade.	*Colombo Value.*	*Remarks.*
B.O. Pekoe and B.P. bulked	70 Nom.	Good size, black leaf, little flaky, fair show of bright tip.

Liquor—fair strength and colour.

Infused leaf—fairly bright, little mixed.

The leaf is of useful size and colour and although a little flaky, has a good show of bright tip.

The liquor has fair strength and colour, but is rather lacking in quality. This, however, can hardly be expected from an elevation of 250 feet above sea-level."

(3) Report by Messrs. Cumberbatch & Co., Ltd., Colombo, dated 29-8-32.

"We are in receipt of your letter dated the 16th instant together with samples received under separate cover, and append below our remarks thereon for your information :—

B.O.P.	Useful size, little irregular, curly, black, good show of tip. Coloury, plain, little strength and quality. 45/48.
B.P.	Useful size, fairly even and open, greyish, few dull tips. Coloury, plain, little strength and quality. 24/26.
O.P.	Useful size, fair twist, little mixed, greyish, few dull tips. Light and plain, little strength and quality. 28/30.
Pekoe	Good size, even, choppy and open, greyish. Fair, colour, plain, little strength and quality. 24/26.
Fannings	Useful size, little mixed and open greyish, fair tips, few fibres. Good colour, plain, little strength and quality. 28/30.
Dust	Useful size, powdery, greyish, few fibres, little sand. Good colour, plain, little strength and quality. 18/20.

Costs of bringing Tea into bearing.

The following is an estimate of the cost of bringing a small lowland tea estate into bearing. It must be appreciated that although many of the items represent actual costs at the Experimental Plantation, Serdang, under estate conditions, management and other factors might result in a considerable variation in many details.

No allowance is made for cost of supervision, survey fees, recruiting and medical charges, or water supply. It is considered, however, that the costs recorded serve a twofold purpose since they provide a summary of the operations necessary in the opening and management of a young tea estate.

Estimated Costs of Bringing Lowland Tea into Bearing.

	Costs per acre.	
Preparation of Land.		
Tools and Stores ...	$10.00	
Rent and premium ...	7.50	
Felling, burning and clearing ...	8.00	
Stumping and levelling ...	45.00	
Contour pits and soil conservation ...	12.50	
Cover crops and green manures ...	7.00	$90.00
Cost of Seed and Nurseries.		
Cost and transport of Indian seed ...	80.00	
Preparation of sand beds and planting seed ...	5.00	
Watering and weeding ...	3.00	
Preparation of nursery beds and attention ...	20.00	
Removal of shade, lifting and transplanting stumps ...	10.00	
Additional seed for supplies up to 3rd year ...	15.00	

Lifting and transplanting supplies to field	...	10.00	$143.00
Planting.			
Lining and pegs	...	10.00	
Holing	...	15.00	
Planting and shading	...	16.00	
Supplying ⅓ area	...	15.00	
Supplying to 3rd year	...	10.00	
Shade trees, seed, nursery and planting	...	4.00	$70.00
Upkeep for Three Years.			
Weeding at $2 per month	...	72.00	
Upkeep covers and green manures at 50 cts. per month	...	18.00	
Lalang eradication at $2 per annum	...	6.00	
Pruning and topping bushes	...	8.00	
Upkeep of contour pits at $3 per annum	...	9.00	
Drainage at $3 per annum	...	9.00	
Pruning mixture and application of fertilisers		16.00	
Removal of prunings and envelope forking	...	4.00	
Pruning shade trees, 2nd and 3rd years	...	2.00	$144.00
Factory Capital Charges.			
Actual cost of factory capitalised on 150 acres			$133.00
Roads, Bridges, Bungalows, Coolie-lines and Stores.			
Estimate	...		$120.00
Cost per acre	...		$700.00

To secure a proper appreciation of the costs recorded it should be borne in mind that a considerable proportion of the work undertaken is charged at approximately 20 per cent. higher labour costs than are now current. In addition the smallness of the area of tea grown at Serdang results in increased expenditure. Although tea planting is a comparatively expensive form of cultivation it is considered that at the present time small areas of lowland tea might be brought to the plucking stage for $500 per acre, including cost of factory and machinery. On land opend from jungle where a leguminous plant such as *Crotalaria anagyroides* is established, weeding cost can at present be kept as low as 35 cents per acre per month.

Conclusions.

An attempt has been made at the Government Plantation, Serdang to cultivate and manufacture lowland tea. The results obtained are satisfactory, since black tea of good quality is produced which is readily saleable locally, and well reported upon both in London and Colombo. The yield of eight-year old tea at Serdang is shown to exceed 1,000 lbs. made tea per acre for a 12 months

plucking round. This yield is governed to a large extent by the system of plucking employed, which as far as circumstance permitted, has been kept "fine".

Opportunity for expansion of production of black tea for local consumption is distinctly limited. The possibility of a market for such tea in Australia might, however, well repay investigation. There is a comparatively large local demand for China tea and teas of partially or totally unfermented types agreeable to many Asiatics. This branch of tea production is receiving attention by the Department of Agriculture.

Acknowledgments.

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(3) The Cultivation and Manufacture of Tea in Ceylon and India. Department of Agriculture,S.S. and F.M.S. General Series No. 9, 1932.

(4) Tea Cultivation and Manufacture in Ceylon, *Malayan Agricultural Journal,* Vol. XVIII, 1930, page 428.

(5) Tea Growing in the Sungei Besi District of Selangor, *Malayan Agricultural Journal,* Vol. XVII, 1929, page 12.

FURTHER OBSERVATIONS ON THE DWARF COCONUT PALM IN MALAYA.

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Introduction.

The yellow, the red and the green varieties of dwarf coconut palm were first fully described in this Journal by Jack and Sands* in 1922. Later, as a result of systematic observations over several years on five palms of each variety at Parit Buntar, the same authors† published a further statement and included therein some interesting statistics which they had compiled from the production records of six estates.

It was shewn that "given suitable conditions and fair treatment, the dwarf palm (particularly the green race) is a sound commercial proposition".

The Government Coconut Experiment Station.

A further development of the study of dwarf palms has occurred with the establishment of the Coconut Experiment Station at Klang, where between 1924 and 1929 a few acres were planted with dwarf palm seedlings which had been obtained from Parit Buntar and elsewhere.

The seedlings were planted triangularly allowing 100 palms per acre. The 1929 plantings derived from the palms studied at Parit Buntar are just coming into bearing while the older palms obtained from various sources and from palms of unknown yielding ability, which are now about 7 years old are giving average yields of 40 fruits per palm per annum for the green and yellow varieties, and 30 per palm for the red variety, which is equivalent to 11.4, 8.4 and 7.6 piculs per acre respectively calculated on the basis of the weights of copra per nut given in column 6 of Table IV.

The soil is a stiff alluvial clay, fairly well drained having transverse 2½ foot drains, at 60 foot intervals, leading into a 4 foot main lateral drain. Being low-lying the plantation was at one time liable to sea-water flooding at very

* *Malayan Agricultural Journal*, Volume X No. 1, 1922 "The Dwarf Coconut Palm in Malaya"

† *Malayan Agricultural Journal*, Volume XVII No. 6, 1929 "Observations on the Dwarf Coconut Palm in Malaya".

high tides. This adversely affected the growth of the palms and an improvement was noticeable soon after the installation of a "flap-trap" water gate in 1931 in the main drain outlet.

Drainage in wet weather, however, is not quite adequate but if the drains were deepened the palms might then suffer from drought in dry weather.

The growth of the palms is nevertheless satisfactory and the yields while fairly good, are lower than those of dwarfs growing under optimum conditions. The quality of the copra from both the dwarf and the tall palms on the Experiment Station is above average as may be seen from Table IV.

The Dwarf Palm under Estate Conditions.

Meanwhile plantings of dwarf palms under estate conditions have also taken place. The fact that dwarf palms could yield an economic crop after five years as compared with eight years for tall palms has been an attraction, especially where working capital was so limited that a speedy financial return was necessary; while added interest has been gained for this type of palm because of one instance in which the very fine crop of over 19 pikuls per acre per annum was recorded from seven year old palms. While, however, on a few estates the yield of copra per acre from dwarf palms is greater than that from mature tall palms, in other cases the palms have yielded so poorly that the crop is regarded as hardly worth harvesting although adjacent tall palms have given satisfactory yields.

This emphasises the warning given by Jack and Sands that "where conditions for growth are good, the dwarf palm gives excellent returns, but where conditions are only fair or rather difficult they are not so satisfactory". This warning was, perhaps, insufficiently emphatic in view of our present knowledge of the rapid deterioration of dwarf palms in poor soil conditions.

Information has been received within the past few months from estates with both tall and dwarf palm cultivation that, at least for the immediate future, only tall palms will be planted in new areas or as supplies, even though in two instances yields from dwarf palms are good.

A consideration in connection with the cultivation of dwarf palms which must not be lost sight of is the additional cost of preparing these nuts for manufacture. It has been computed that it costs the equivalent of 5 cents more per picul of copra to husk and split dwarf palm nuts than nuts from tall palms. If large yields of good copra are obtained from areas of dwarf palm, then this added cost is covered, but where yields from dwarf palms do not greatly exceed those obtainable from tall palms, this factor cannot be overlooked.

By far the most commonly planted and best known variety of dwarf palm and that from which the bulk of estate experience and production figures have been obtained is the "yellow" variety; this is largely due to the fact that previously, supplies of this type only were available in sufficient numbers: the green dwarf palm has only very recently been selected exclusively for planting on estates.

TABLE I.

Comparative Yields of Copra from Dwarf and Tall Coconut Palms on Four Important Estates in the Coastal Districts of Selangor & Perak.

Estate	Soil Conditions	Type of Palm	Planted	Yields of copra in pikuls per acre											
				1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
A	Rather high-lying stiff alluvial clay, deeply drained and well-irrigated. Dwarf palms given extra irrigation since 1931.	Dwarfs	1921	—	—	—	—	—	4.00	4.73	19.29	16.88	21.60	18.88	22.60
		Talls	1914 onwards	3.85	6.11	5.87	5.30	5.10	6.12	7.71	6.64	7.76	10.72	10.40	9.55
B	Loamy alluvial clay, well drained and irrigated since 1915. Dwarf palms intensively irrigated since 1931.	Dwarfs	1921	—	—	—	—	—	5.40	7.03	14.33	8.94	14.88	14.93	15.18
		Talls	1905 onwards	14.00	13.25	12.65	12.65	13.07	14.12	12.14	12.88	13.31	12.35	12.81	14.20
C	Light, peaty alluvial clay, very well drained. Irrigated since 1931.	Dwarfs	1920	—	—	—	3.20	8.53	8.50	7.00	11.47	7.55	7.88	3.64	7.50
		Talls	1910	8.60	9.31	9.19	10.00	9.90	12.20	11.05	12.00	11.95	11.86	10.59	11.13
D	Low-lying stiff alluvial clay, in places sandy or peaty, with areas where sulphurous ooze may be seen in the drains. Well drained.	Dwarfs	1920 onwards	—	—	—	—	5.67	10.85	6.97	10.58	3.09	4.33	3.60	4.75
		Talls	1916 onwards	—	—	—	—	—	8.50	8.74	9.72	10.02	9.62	9.63	9.56

The Correct Environment for the Dwarf Palm.

It seems evident that dwarf palms will only give their remarkable yields of fruit and copra under certain specific conditions. They are more sensitive than tall palms to an environment that is less than optimum and will show quicker response to improvement or deterioration in conditions.

They appear to favour a soil stiffer than that which is most suitable for tall palms and require greater attention to drainage. Furthermore, they benefit greatly by irrigation and will give increased yields with any system which ensures perfect water movement through the soil. Under such conditions they appear to prefer a water table which is slightly higher than that which seems best for tall palms, (about 2½ feet as opposed to 3½ feet).

Low-lying, brackish, and sulphurous soils appear to offer to dwarf palms an even more unattractive environment than they do to tall palms, while deep peat in which the water level changes seasonably is also unsuitable as it may become seriously affected by drought.

Yields in excess of 22 piculs per acre per annum have been obtained from 12 year old dwarf palms on one estate. Here the soil is a very stiff alluvial clay, very well drained, and irrigated with fresh water. On another estate (estate C in Table 1) the soil is a friable, peaty clay, and was so well drained that the water level was drawn away from the roots of the dwarf palms, resulting in a considerable falling off in crop due to a decrease in the size of nuts as well as in the number of nuts per palm.

Irrigation was adopted for the dwarf palms on this estate for the first time in 1931 and they have quickly shown an improvement in size and numbers, while the prospect for 1933 is a likelihood of further improvement.

The system of irrigation employed on these estates is, briefly as follows: alternate drains are filled with water, and the remainder forming a separate system are kept fully open or are maintained with a lower level of water, so that there exists a constant difference in water level between the two systems.

Another possible reason for decreased and poor yields from dwarf coconut palms is found in Estate D which is typical of much low-lying coastal land closer to the seashore than the other estates referred to in the Table. Here there is often found in the drains a sulphurous-smelling, dark, oily fluid, the product of inorganic matter decomposing under anaerobic conditions and often found in very young coastal alluvial areas.

Quality of Copra from Dwarf Palms

During the past four years, special attention has been given to the question of improved copra manufacture in Malaya, and in this connection the quality of the copra obtainable from dwarf palm coconuts has come under observation.

Jack and Sands have stated that copra derived from the yellow dwarf type was difficult to cure and that this type of dwarf greatly predominated in local plantations of "dwarfs". They also stated that "the price obtained by estates for copra derived from dwarf palms does not differ materially from that paid for copra from tall palms, in fact most estates do not even separate them in preparing consignments for sale." This latter statement shows that the local market was not a very discriminating one in 1927. Actually, even now, copra standards in Malaya are ill defined and although increasing quantities of improved copra are being produced, low grade copra, being available in large quantities, still rules the local market. For this reason ordinary estate-produced copra obtained from dwarf nuts, containing a moderate percentage of off-quality copra, could still be classified as sundried in the ordinary local market.

TABLE II.

Comparative Statement of Quality and Yield from Dwarf Coconut Palms, Predominantly of the Yellow Variety.

Estate	Soil	Water Movement	Yield of copra in p.p.a. 11th year	Number of nuts per picul of copra	Percentage of rubbery copra	Contemporary yield of copra from adjacent mature tall palms
A	Stiff, alluvial clay	Deeply drained and well irrigated	22.60	550	80	*9.55*
B	Loamy, alluvial clay	Well drained and well irrigated	15.18	550	70	*14.20*
C	Light, peaty, alluvial clay	Excessively drained	3.64§	1000‡	—	*10.59*
D	"Sulphurous" alluvial clay	Low-lying but well drained	3.60	520	56	*9.63*
E	Alluvial clay	Deeply drained†	6.00*	535	58	—

† Estate was neglected in 3rd and 10th years when lalang was allowed to become well established.

* 21st year.

§ In the 6th year yield was 8.53 pikuls p.a. and no. of nuts per pikul = 550.

‡ In 12th year, after the adoption of a system of irrigation, yield rose again to 7.50 p.p.a. and no. of nuts p.p. fell to 723.

A rubberiness of texture is an important defect of Malayan copra and of dwarf palm copra in particular and in this connection it is important to note the opinion of an expert in England when comparing ordinary Malayan copra with the best copra available in the European market. It was stated that when pressure was applied to the copra, the oil flowed satisfactorily but when at the end of the operation the pressure was released, the cake tended to suck up oil owing to the material still having what may be termed a slight elasticity.

A very determined effort is now being made both on estates and in the kampong to advance the quality of Malayan copra in order to obtain an improved price. Where high grade copra is now available in sufficient quantity to command a special price, unsightly pieces of rubbery copra are rigidly excluded and sold separately at a very reduced price.

Information having been received that it is difficult to prepare hard copra from dwarf coconuts, and that dwarf copra is inferior in quality to tall palm copra prepared under good conditions, it was first decided to make a preliminary examination of estate-produced dwarf palm copra, as marketed at the port of shipment. The copra was inspected principally for texture, the pieces being classified as follows :—

Smooth and Crisp :— The brown testa is smooth, the copra will crack very sharply when bent and there is no excessive shrinkage or distortion.

Rubbery :— The brown testa is rough and corrugated, and the copra, if normally dried, may be bent like rubber without cracking. Such copra is generally shrunken, distorted, unsightly and often broken.

Intermediate :— The copra breaks reluctantly when bent and is often distorted.

The results of the random examination were as follows :—

Table III.

An Examination of Estate Produced Dwarf Copra.

Estate	Texture of Copra.		
	Smooth Crisp	Intermediate	Rubbery
	per cent.	per cent.	per cent.
F	32	30	38
G	28	48	24
H	6	15	79

Copra from Tall and Dwarf Palms.

Upper and Lower (Tall) :—smooth, round crisp copra.

Centre (Dwarf) :—wrinkled, distorted, rubbery copra.

Table IV.

Comparison of Dwarf and Tall Palm Copra from Adjacent Areas on Different Estates.

Source	Description			Percentage Texture of Copra			General Appearance of Copra.	Yield	
	Palms	Type	Remarks	Smooth Crisp	Intermediate	Rubbery		Copra (lbs.) per nut	Nuts per Picul
Government Experimental Plantation Estate D	Tall			98	2	0	Very good	.64	208
„ B	„		(best)	97	0	3	„	.67	200
„ D	„		(best)	92	4	4	„	.64	208
„ B	„		(worst)	92	2	6	Good	.62	215
„ A	„		(worst)	84	8	8	Very good	.54	247
Malay Kampong	„			86	4	10	Good	.60	222
	„			84	8	8	„	.47	284
Government Experimental Plantation Estate E	Dwarf	Green		70	20	10	Fairly good	.38	350
„ B	„	„		68	18	14	„	.36	370
	„	„		38	26	36	Poor	.28	370
Government Experimental Plantation Estate D	Dwarf	Yellow		30	52	18	Poor	.36	477
„ E	„	Mixed	(best)	14	30	56	„	.27	494
Government Experimental Plantation Estate B	„	Yellow		12	40	58	„	.26	513
„ A	„	Red		8	42	50	„	.34	392
„ B	„	Yellow		6	24	70	„	.28	477
„ A	„	„	(best)	6	14	80	„ „	.26	513
„ D	„	Red		4	32	64	„	.36	370
„ E	„	Yellow	(worst)	4	16	80	„	.20	667
	„	Mixed	(worst)	4	8	88	„	.24	555
	„	Red		4	4	92	„	.26	513

Following this, twenty lots of fifty dwarf and tall palm coconuts were obtained from adjacent fields from five estates, from the Government Coconut Experiment Plantation at Klang, and from a nearby Malay smallholding. The experimental kiln was divided off as required so that copra could be simultaneously produced from all the different lots of nuts, under conditions of manufacture calculated to produce normally a hard smooth and round product.

The various lots of copra obtained were weighed and then tested piece-by-piece. The full results are given in Table IV. When this is examined it will be seen that even under careful conditions of manufacture, and on an under loaded kiln, dwarf coconuts of whatever variety do not yield copra equal in quality to that obtainable from tall palms growing nearby.

It is to be feared therefore that if increasing supplies of dwarf palm copra are ultimately forthcoming or if the general quality of Malayan copra materially advances a large percentage of the copra obtainable from dwarf palms will have to be relegated to a lower grade.

TABLE V.

Summary of Results.

Copra ex	Appearance	Percentage of rubbery pieces	Nuts per picul of copra.
Tall nuts	good	0 — 10	200 — 284
Green dwarfs	fair	10 — 36	350 — 370
Yellow dwarfs	poor	18 — 80	477 — 667
Red dwarfs	very poor	50 — 92	370 — 513

Conclusions.

The conclusions to be drawn may be summarised as follows :—

1. The dwarf coconut palm appears to be more sensitive to unfavourable conditions than the tall palm, and responds rapidly and remarkably to improvement or deterioration in conditions.
2. While very remarkable yields at an early age are obtainable if conditions are favourable, in most instances yields are only fair or poor because the conditions do not fulfil the exacting requirements of the dwarf palm.
3. Free water movement in the soil is essential for good growth and the soil should not be allowed to dry up.
4. The best results have been obtained on very heavy clay.
5. The copra from dwarf palm nuts is of inferior quality to copra prepared from ordinary tall palm nuts on a good kiln, and is unlikely to obtain a premium even if special care is exercised in manufacture.
6. The best dwarf palm copra is obtainable from the green variety, and the worst from the red variety.

PACKING AND TRANSPORT OF PALM OIL.

Prepared by the Economics Branch of the Department of Agriculture, S.S. and F.M.S.

The heaviest items of cost in connection with the manufacture and marketing of palm oil from estates are packing and transport.

At a time when the market price of the oil left ample margin for profit, this high cost was of less importance; also it was unavoidable because of the relatively small quantities of the oil available.

Until recently, Malayan palm oil has been exported in barrels. The barrel usually employed was of Californian Douglas fir on account of the fact that much of the oil was exported to the United States of America where there was a preferential tariff on barrels of American manufacture.

The barrel has a capacity of 40 gallons (375 lbs. of oil) so that six are required per ton of oil. The present cost is $6.70 each to which must be added the cost of assembly on the estate.

On this basis, barrels for the Malayan palm oil exports of 1931 would have involved a cost of nearly $200,000. It must be remembered, however, that this sum is not a total loss to the exporter, as oil in barrels commands slightly higher prices than "naked" oil.

Efforts have been made by the Forest Department to select suitable local timber for barrels and to train local coopers. Recent reports* from the Department indicate that some measure of success has been achieved with staves made of wood known as meranti pa'ang, with a bung stave of resak wood.

A local barrel factory has now commenced operations from which satisfactory oil-tight barrels are made of local timbers at competitive prices. Trials of these barrels, which cost $5 each, are being conducted by Department of Agriculture.

A report received on 20th January 1933, from a firm of London brokers on the condition on arrival of 13 barrels locally made from Malayan timber, containing palm oil, indicated that there was room for improvement in their construction.

The obvious alternative to the export of palm oil in barrels is its export in bulk. In order to make this possible, regular and large supplies must be forthcoming for shipment to buyers of large quantities. The increasing quantity of oil available from the estates controlled by one firm rendered it possible to organise bulk shipment from Malaya in 1931, a description of which is contained in the *Malayan Agricultural Journal* Vol. XIX No. 12.

The net exports of palm oil from Malaya increased from 768 tons in 1927 to 7,905 tons in 1932, while by 1935, the annual Malayan production should

* Monthly Research Bulletin of the Forest Department, S.S. and F.M.S.

exceed 20,000 tons. In view of these facts, further developments in the transport of palm oil are inevitable and desirable.

Land Transport in Bulk.

The Federated Malay States Railways are now operating a scheme for the bulk transport of palm oil on their railway system in tank wagons. They are now in a position to provide suitable tank wagons for the transport of palm oil and to maintain these without charge, making, however, a small additional charge calculated to recover the capital cost of the wagons in the course of a few years. They are also prepared to equip these tank wagons with heating coils and such other fittings necessary as may be mutually agreed between themselves and the consignors.

Sufficient tank wagons will be provided for the conveyance of the oil from any one estate, and if the volume of traffic justifies it, a number of tank wagons will be alloted for the exclusive use of any one sender.

While senders will be solely responsible for the satisfactory cleaning of the tank after use, whether they are reserved for their exclusive use or not, no demurrage will be charged in connection with any tank wagon which may be set apart for the exclusive use of any one sender.

The transport of palm oil in railway tank wagons is in its initial stages. It is already in operation from one station in Selangor and arrangements have been completed to commence its operation in Johore early in 1933. The transport rate for palm oil in railway tank wagons varies, depending on conditions governing each case, such as length of haul. The rates may vary from 4 to 8 cents per ton mile. More definite information can be obtained from the F.M.S. Railways in connection with particular applications.

Water Transport in Bulk to Singapore.

Under arrangements with a local shipping firm it is proposed to construct a tank lighter for the conveyance of palm oil from the coast of Selangor to Singapore.

This lighter will have a carrying capacity of 220 tons and be divided into several tanks in order that it may steam successfully without a full cargo. It is expected that the vessel will be ready for use by the end of May 1933.

The cost of transporting oil by this means to Singapore from the Bernam or Selangor river is anticipated to be in the neighbourhood of $4 per ton.

Wherever estates are conveniently situated on the river side, oil will be stored in 50 or 100 ton tanks where it can be pumped direct into the lighter. In the case of estates which are inaccessible to the lighter or which have no river frontage, it is proposed to erect a small bulking installation at a convenient site on the Selangor river which will consist of three 100 ton tanks to which oil will

be conveyed either by water or tank lorry from the various estates. The lighter will then call at the installation at regular intervals to transport the oil to Singapore for trans-shipment.

Bulk Storage at Port.

The use of tank railway wagons entails special facilities at the port for the reception and storage of the oil until such time as it can be loaded into specially prepared tanks in ocean ships.

Such port facilities are at present being arranged by the Singapore Harbour Board. This Board has arranged to provide an installation of three tanks of 500 tons each, with the relative pumping apparatus. The installation is so arranged that oil can be received either by rail or sea.

The Singapore Harbour Board is to lease this installation to a local firm which is closely and extensively connected with the cultivation of oil palms.

Subject to sanction of the Singapore Harbour Board it is the intention of this firm to grant a sub-lease on almost identical terms and at the same rental to a Service Company to be locally formed to operate the installation purely as a transport organisation, the object being to provide facilities for bulk shipment at the lowest possible terms and at the same terms for all producers. There will be no discrimination as between producers in the charges for the use of the installation which will operate on a definite non-profit earning system.

The captital required will be almost nominal and is being provided by the palm oil producers in proportion to their interests.

The estimated cost of reception at the installation and subsequent pumping on board ship is estimated not to exceed $5 per ton, but in the absence of actual experience this estimate is necessarily tentative. The cost will naturally vary with the quantity handled and with increasing production it should become less.

There is no intention that the Service Company shall buy or sell oil on behalf of producers. It is recognised that bulk transport may give rise to difficulties in the case of small producers, but the Managing Agents of the Service Company state that they will do all they can to assist such producers.

The provision of better transport facilities for bulk shipment of palm oil, such as are being put into operation, is estimated to effect a saving of fully £5.10.0 per ton to producers, which will be a very distinct gain to estates which in many cases must now be working on a very small margin between profit and loss.

NOTES ON CERTAIN SUBMERGED AQUATIC WEEDS IN PADI FIELDS.

BY

N. H. Sands.

Agricultural Officer — Kedah.

In Kedah during the past season, when the rainfall over a period of 3 months was fairly continuous, submerged aquatic weeds became exceedingly abundant in the flooded padi fields of the Telok Chengai Experiment Station and elsewhere, and by forming in dense masses around the young padi plants checked considerably their growth and development. The planting of padi was completed in the Station on August 20th, and 18 days later it was observed that the aquatic weeds *Utricularia flexuosa,* Vahl., and *Blyxa Malayana,* Ridl., were fairly numerous. The former is an insectivorous plant with long very finely divided leaves to which are attached bladder traps; the latter is a stemless plant with a rosette of long narrow grass-like leaves. Little importance was attached to these as in previous years they were present, but not in large numbers.

The first weeding of the fields was carried out in the second week of September, but by October 6th, masses of *Utricularia* and two other aquatic plants were observed whose growth was so excessive that constant weeding was subsequently necessary in order to maintain the padi in a healthy condition.

The additional plants were *Enhydrias angustipetala,* Ridl., and *Chara gymnopitys,* Brann. Those two species, together with *Utricularia flexuosa* are known collectively as 'lumut' (moss). *Enhydrias* has long thin stems and numerous short narrow leaves, whilst the *Chara* is densely branched, with the branches covered by large masses of very small leaf-like organs. If left for even a few days the whole surface of the soil becomes carpeted by these weeds.

The reason for the rapid growth of the plants could only be accounted for by the fact that during September, October and November, the rainfall was sufficiently frequent and heavy to maintain a high water-level in the fields: the precipitation being as under:—

September	October	November
9.40 ins.	12.51 ins.	16.23 ins.

From the 23rd October to 8th November—a period of 17 days—no less than 16.96 inches of rain were recorded.

It was at one time thought that the practise of spreading the straw after harvest in the Station, instead of burning it, as is the common local method, might have produced conditions favourable to the growth of 'lumut', but in surrounding fields where the straw had been burnt, the weeds were equally

numerous, so that there was little doubt but that the heavy rainfall was responsible for their abnormal development.

Local planters state that after an interval of a few years these aquatic plants become very troublesome, so much so, that some growers have been known to broadcast salt in their fields after harvest. This practice may be the result of observations made in areas near to the coast where these particular weeds are said not to thrive.

The removal of masses of submerged growth by hand from the fields was laborious, slow and expensive so that a specially designed tool was made to facilitate the work. This took the form of a rake with a number of bent pointed ¼ inch iron tines. The tines were joined together at the base and spread out fanwise. The best spacing of tines was found after trial to be 1 in. to 1¼ in. but the number of tines would vary according to the spacing of the plants—8-9 being the most suitable number for plants spaced from 15 ins. to 18 ins. apart. The length of a tine from base to point was 16 ins. The total length of the tool with handle being about 4 feet and the cost from two to three dollars.

The rake proved very useful, not only for enabling the weeds to be quickly collected in heaps, but also served to cultivate lightly the soil around the plants. The rake could also be used for shallow-rooted and floating aquatic plants which often thrive in wet padi areas.

Abstract.

PRESENT-DAY TEA CULTIVATION IN SOUTH CHINA.

By Dr. A. Steinmann. *De Bergcultures,* 1932, No. 39, pages 1027—30.

In view of the comparatively large imports of China tea into Malaya it is thought that a summary of a translation of the above article will be of local interest. China is still by far the largest grower though the greater part of its produce is consumed within the country. The manufacturing methods described in this article are similar to those employed by Chinese growers in Malaya. A description of local manufacture was published in the Malayan Agricultural Journal, Vol. XVII, page 12.

The exports of tea from China have fallen considerably during the last sixty years. Whereas in 1867 China possessed 90 per cent. of the world's tea trade, in 1905 it had fallen to 29 per cent. and since then it has declined still further. This loss of trade is due mainly to the fact that China proved to be incapable of modernising its methods of production against increasing competition from other countries, notably Ceylon, Java and Japan.

In this paper Dr. Steinmann describes a visit to a tea plantation near Canton in the Tsing Yuen district. A large number of small-holdings devoted to tea cultivation are located on the slopes of hills round the Pi-Ka mountains. The estate visited and described was situated at an elevation of about 660 feet above sea level on these hills. The soil is stony and the surrounding vegetation consists of grasses and ferns. At irregular intervals throughout the tea plantations, clumps of *Pinus Massoniana* are closely interplanted. These trees serve as a source of firewood and are a common feature of the scenery near Hong Kong and Canton. The tea cultivated is raised from seed from indigenous plants found growing in the Pi-Ka mountain range.

Seed for sowing is collected in August and sown during the rains in the following February. Throughout the interval the seed is exposed to sunlight on trays of plaited bamboo to keep it as dry as possible. The land is lightly cultivated and the seed sown directly in the field, three to four seeds per hole. Successes ranging from 80 to 90 per cent. are claimed to be obtained. The tea bushes are planted in rows two feet apart, the spacing in the rows being about one foot between each plant. As the tea bushes mature the pine trees are removed. Manure is not generally used but farm manure and ground nut cake are employed on many holdings.

Plucking commences when the tea bushes are three years old. On the estate visited eight pluckings are undertaken during the year. The plucking routine is as follows: two pluckings in April, followed by pruning in May, and the bushes rested until the end of July. Three pluckings in August followed by a rest in September. A further three pluckings in October after which the bushes are pruned and rested until the succeeding year. The first plucking in

April and August consists of buds from the axils of the leaves yielding the first quality tea. During the growing period after pruning, between May and August, the shoots became 3 to 5 inches long. The secondary shoots formed in September provide a crop which is plucked in three relays during October. Since rain is considered detrimental to the crop, picking is done as far as possible during fine weather.

Manufacture is very primitive, and is undertaken at evening by the same men who have plucked the leaf during the day. The crop, without previous withering, is dried directly in iron pans over a fire until the leaves are soft and can be rolled. The time required varies according to the intensity of the fire but is usually half an hour. The leaves are first rolled with the hand for a quarter of an hour and become darker in colour. Finally the leaves are dried, partly in the sun and partly in iron pans.

The manufactured tea is packed in bamboo baskets and transported to Canton. After blending, and in some cases perfuming, most of the tea is packed for local sale.

J. N. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

Hot and fairly dry conditions prevailed over most of the Peninsula for the first three weeks of the month with a tendency towards heavier rainfall during the last week in Krian, Province Wellesley and Perak.

An exception in the matter of rainfall was the coastal region from Singapore to Malacca where heavy rain was experienced during the second week of the month and the total figures for the month in this area were above average for March, many heavy downpours being experienced.

In Selangor and Negri Sembilan the precipitation was average for the month. The effects of the mid-month wet period mentioned in the preceding paragraph extended inland to parts of Negri Sembilan.

Over the remainder of the inland region comprising Kedah, Province Wellesley, Perak and West Pahang the rainfall was generally below normal for March.

In the East Coast region the figures approximate closely to the average records for the month.

Remarks on Crops.

Rubber. Little change occurred in the range of local prices offered for small-holders' rubber. The highest and lowest prices recorded in dollars and cents per picul are—Smoked Sheet, $5 to $8.50; Unsmoked Sheet, $4 to $7; Scrap 70 cents to $3. The average Singapore price for small-holders' rubber was $7.60 for Smoked Sheet, $6.80 for Unsmoked Sheet and $2.50 for Scrap.

Owing to the continuance of dry weather Mouldy rot disease was generally quiescent, but reports of the presence of leaf mildew, *Oidium Heveae*, have been received from Province Wellesley, Negri Sembilan, Malacca and Johore.

In Province Wellesley only a few mild cases were noted.

In Negri Sembilan the area specially concerned was that between the coast and the main range. In Malacca there was a general outbreak, the chief centre being Alor Gajah. In Johore three estates reported the disease whilst several areas of small holdings were affected, especially in Tangkah area, where the disease has been noted before, and around Parit Karoma and Labis.

The Rubber Research Institute gave some demonstrations at Bhutan Estate, Nilai, of dusting, using three different machines and different preparations of sulphur powder.

An appreciable increase in the number of untapped holdings is reported from Province Wellesley and Krian where the harvesting of padi demanded attention.

Padi. Yields of the recently harvested crop in Kedah and Province Wellesley are stated to have been very satisfactory. In Kedah, actual figures of the estimated crop are not yet availble, but for Province Wellesley it is stated that the average return per acre is approximately 300 gantangs, whilst in Penang the average is over 400 gantangs per acre. With regard to Krian the yields have been very good over the South-eastern portion of the District, but are only moderate over the North-western portion. Some still remains to be reaped in the last mentioned half of the District. A feature of the Krian harvest has been the large volume of business transacted by the Government Rice Mill, Bagan Serai, where the buying price for padi has been maintained at $1.62 per pikul. In Negri Sembilan, preparations for planting the next crop have begun, except in Kuala Pilah District where dates follow more closely the general season for the main padi areas of the Western portion of the Peninsula. In this District an attempt is being made to produce two crops in the year on an area near Sri Menanti. Clearing is in progress preparatory to planting the first short season crop. In Pahang crop returns are not yet completed but are available for Temerloh and Bentong Districts where, as anticipated, both total yield for the area and the average return per acre is computed to be higher than for last season. Preparations for the next crop have begun in the riverine mukims of Pahang and in Johore.

Coconuts and Copra. The price of copra has declined during the month, the lowest Singapore quotation being $3.55 per pikul for mixed copra. In areas where the demand for eating nuts is an important factor such as Penang and Province Wellesley the price of nuts for copra production has not fallen in the same ratio as the copra price and, consequently, some small manufacturers of copra have sustained a loss on their working.

Further progress on the improvement of kilns erected by small-holders is recorded. In the Sungei Acheh area of Province Wellesley a further kiln has commenced production and another is completed. In the Bagan Datoh area, improvements recommended for a brick kiln have been carried out and another brick kiln is in course of construction. A survey of the Chinese kilns in Central District of Malacca revealed that 50 are in existence but all are of faulty construction. Advice on the nature of improvements needed was given.

Samples of copra received from Johore were reported upon by the Assistant Chemist for Copra Research.

Tobacco. Renewed interest in this crop is reported from Province Wellesley where the best quality cured leaf realised $45 a pikul and medium quality $30. Interest in the crop is maintained in Singapore by Chinese market gardeners who dispose of green leaf to manufacturers of Chinese and cigar types of tobacco.

Agricultural Stations

Considerable further progress was made during the month on planting up the Bukit Mertajam Station in Province Wellesley. At other stations, arrangements have been made with a view to having planting material ready for further planting and for supplies during the anticipated wet weather of next month. At Singapore, the yields on the Pineapple Station have noticeably fallen off, indicating the close of the first fruit season. In the series of cultural trials yields from the Pabco mulched plots have been the highest.

Padi Stations and Test Plots.

Many records of yields for manurial, cultural and varietal trials have been received at headquarters for statistical examination and weighing of the remainder is in progress. Records from all stations are expected to be completed shortly. Next season's programme for varietal trials at the stations in Pahang, Johore, Selangor and Negri Sembilan, where planting is early, have been laid down and in many cases the seed has been sown.

DEPARTMENTAL NOTES.

Visits and Tours.

Dr. H. A. Tempany, C.B.E., Director of Agriculture, visited Singapore from the 8th to the 11th of March. During his visit he inspected the Pineapple Experimental Station, and visited the Singapore Cold Storage Company's Dairy Farm at Bukit Timah.

The Director also made a tour of the districts in the Negri Sembilan from March 20th to 22nd. He was accompanied by the Chief Field Officer, Mr. F. Birkinshaw; the Agricultural Field Officer, Negri Sembilan, Mr. W. H. Barnes, and Mr. R. G .H. Wilshaw who has been appointed to succeed Mr. Barnes on the latter's retirement. The opportunity was taken, during the tour, to discuss matters of policy with the Administrative officers in many of the Districts.

On March 26th the Director, accompanied by the Acting Agricultural Chemist, Major C. D. V. Georgi, O.B.E., was present at the opening, by H.H. The Sultan of Johore, of the new oil palm factory on Ulu Remis Estate, Layang-Layang, Johore.

In the first week of March the Government Entomologist visited several coconut estates in the Bagan Datoh area in order to discuss with the managers the economic relationship of an insect pest (*Sctora nitens*) to the coconut industry. He also visited Cameron Highlands from March 13th—16th to enquire into the "cut-worm" situation and to supervise the layout of experiments for the control of this pest.

The Acting Government Mycologist, Mr. A. Thompson, visited Cameron Highlands from the 6th to the 9th March and an oil palm estate in Johore from 12th to 14th in order to investigate problems connected with the control of certain diseases.

The Singapore-Johore Agri-Horticultural Show.

The Singapore - Johore Agri - Horticultural Show was held in the grounds of the New World Pleasure Park, Singapore, on April 7th, 8th and 9th, 1933.

It is many years since a similar show has taken place in Singapore and the effort may be taken as marking a decided step in advance.

The Exhibition was organised by a Committee presided over by Mr. John Laycock and comprised representatives of agricultural and horticultural interests in Singapore and Johore as well as members of the staff of the Agricultural and Gardens Departments in Singapore and Johore.

The show was opened by His Excellency Sir Cecil Clementi on April 7th at noon amid a representative gathering among those present being Lady Clementi, the Hon'ble Sir John Scott, Colonial Secretary, the Hon'ble Mr. A. S. Haynes, His Highness the Sultan of Kelantan, Dr. Tempany, Director of Agriculture, the Hon'ble Mr. J. Bagnall, Sir David Galloway and many others.

In his speech His Excellency alluded to the necessity for growing crops

other than rubber and touched on the possibilities of increasing the production of flowers on a commercial scale in Singapore.

The Director of Agriculture thanked His Excellency on behalf of the organisers of the Show for his address and for opening the Exhibition. He stressed the importance of shows in the campaign for broadening the basis of agriculture in Malaya, which has been in progress for some time past.

After the opening His Excellency inspected the exhibits.

The show was also visited on the 7th instant by Their Highnesses the Sultan and Sultana of Johore, who were accompanied by His Highness the Tungku Mahkota. Their Highnesses spent several hours examining the exhibits.

The general standard of the exhibits was high. In addition to a large number of agricultural exhibits there were many entries in the classes for flowers, particularly orchids, vegetables and fruit. The Department of Agriculture staged an exhibit of copra, oil palms, pineapples, and minor economic products (tea, coffee and tuba). Great interest was shown in these exhibits, especially in the demonstration of the striking results obtained by the manuring and mulching of pineapples at the Singapore Pineapple Station. During the evenings, the Co-operative Department displayed their propaganda film.

The attendance during the three days has been estimated at between thirty-five and forty thousand, and the show is considered to have been an unqualified success. It is hoped that as a result of this effort the show may become established as an annual event and prove a useful stimulant to agriculture and horticulture in Singapore and Johore.

Staff Changes and Leave

Mr. A. Sharples, Government Mycologist, and, at present Head of the Pathological Division of the Rubber Research Institute of Malaya, retired from Government Service on December 28th 1932.

Mr. F. S. Ward, Assistant Mycologist, has been granted full-pay leave of four months and twenty eight days, from March 22nd to August 18th, prior to retirement on abolition of appointment.

Mr. W. H. Barnes, Agricultural Field Officer, Negri Sembilan, has been granted full-pay leave, prior to retirement, from April 1st to October 1st.

Mr. R. G. H. Wilshaw, Assistant Chemist, has been seconded to the Field Branch, and assumed duty as Agricultural Field Officer, Negri Sembilan, on April 1st.

Statistical.

MARKET PRICES.

March, 1933.

Rubber.—The highest price recorded in Singapore during March for rubber smoked sheet, equal to London Standard was 6 5/16 cents per lb. on the 4th, and the lowest price 5 14/16 cents on 7th. The average price for the month was 6 1/32 cents per lb. in Singapore, 2 1/32d. London and 31/32 cents gold New York, as compared with 6 4/16 cents, 2d. and 30.1/16 cents gold respectively in February 1933.

Palm Oil.—The course of the English market during the month of March, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool, was as follows; 2nd, £13.10.0 per ton; 9th, £14.5.0; 16th, £14.5.0; 23rd, £13.15.0; 30th, £15.0.0. Prices in the U.S.A. landed weight c.i.f. New York/Philadelphia, were 2.20 cents gold per lb. on 6th, and 2.30 cents gold on 25th of the month.

The price of palm kernels, Fair Average Malayan Quality, c.i.f. landed weight on the Continent ranged between 8 shillings and 7½d. per cwt. and 8 shillings and 10½d. during March.

Copra.—The highest Singapore price for sundried during March was $4.55 per picul in the middle of the month, falling to $3.90 per picul at end of month, the average price being $4.35 per picul as compared with $4.75 in February. The mixed quality averaged $4.03 as compared with $4.32 in the previous month.

Copra cake averaged $1.92 per picul.

Coffee.—The prices at Singapore for Sourabaya coffee ranged from $24.50 to $25.75 per picul, as compared with $25.40 to $27.50 during February, the price within the range depending upon quality.

Palembang coffee averaged $19.80 per picul as compared with $20.40 in February.

Arecanuts.—Palembangs averaged $2.16 per picul and Bila Whole averaged $2.45 as compared with $2.25 and $2.49 per picul respecitvely in February, Singapore average prices for other grades were:—Split $2.90 to $4.50, Red Whole $2.50 to $4.25, Sliced $5 to $7 per picul, the price within each range depending on quality. The price for Kelantans was quoted at from $4.25 to $4.60.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during February:—Siam No. 2 $3.41, Rangoon No. 1 $3.26, as compared with $3.40 and $3.24 per picul during January. The average retail market prices in cents per gantang of No. 2 Siam rice in February were:—Singapore 25, Penang 28, Malacca 27, as compared with 25, 29 and 27 cents respectively in January.

Gambier.—Block Gambier has remained steady throughout the month at $5 per picul and Cube at $8 per picul.

Pineapples.—The average Singapore prices per case in March were:—Cubes $2.95, Sliced Flat $2.80, Sliced Tall $3.04, as compared with $3.19, $2.90 and $3.21 respectively during February.

Tapioca.—There has been a decline in prices towards the end of the month. Flake depreciated from $7.00 to $4.50 per picul towards the end of the month, and Pearl from $7 to $5, the average price per picul of the latter being $5.69 as compared with $5.25 during February.

The price of Flake averaged $5.69 as compared with $4.85 in February and Pearl medium averaged $6.12 as compared with $5.44 in the previous month.

Sago.—Pearl small fair rose slightly during the month, the average being $4.31. Flour Sarawak Fair averaged $1.90 as compared with $1.94 in February.

Mace.—Prices, more or less nominal, are quoted at $62 per picul for Siouw and $40 for Amboina.

Similar prices have ruled for the past four months.

Nutmegs.—The average Singapore prices per picul for 110's were $20.50 per picul and 80's $24.50 per picul, as compared with $21.25 and $25.12 per picul respectively during February.

Pepper.—Average Singapore prices during March were as follows:—Singapore Black averaged $15 per picul, Singapore White $21.31 and Muntok White $21.75, the corresponding prices for February being $15.50, $19.75 and $16.62 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at $40 for Zanzibar and $45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co. Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.*

February 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during February 1933, amounted to 46,275 tons, as compared with 62,573 tons in February 1932, a decrease of 26 per cent. of which 62 per cent. was imported into Singapore, 17 per cent. to Penang, 5 per cent. to Malacca, 14 per cent. to the Federated Malay States and 2 per cent. to the Unfederated Malay States.

Of these imports, 61 per cent. were from Siam, 35 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in February 1933, were 13,975 tons (including 219 tons local production) as compared with 16,346 tons in February 1932, or a decrease of 15 per cent.

Of these exports 83 per cent. were consigned to Netherlands India and 17 per cent. to other countries.

Net imports for the period January - February 1933, were 67,152 tons as compared with 80,564 tons during the same period for 1932, a fall of 17 per cent.

India and Burma.—Total foreign exports of rice during January 1933 were 68,000 tons as compared with 109,000 tons in December 1933, and 168,000 tons in January 1932, a decrease of 38 per cent. in respect of the previous month and a decrease of 60 per cent. in respect of the same period in the previous year.

Total exports of rice and bran from Burma during the period 1st January to 25th February 1933, amounted to 429,928 tons as compared with 600,549 tons in the corresponding period of 1932, a decrease of 28 per cent.

Japan.—No returns.

Formosa.—The area under padi (second crop) in 1932, was 941,108 acres as compared with 887,760 acres in 1931, an increase in area of 6 per cent.

Production was estimated to be 663,000 tons in 1932, as compared with 540,000 tons in 1931, an increase of 25 per cent.

Siam.—Exports of rice from Bangkok (approximate) during February 1933, amounted to 142,051 tons as compared with 114,668 tons (actual) in February 1932, an increase of 23.9 per cent.

Netherlands India, Java and Madura.—For the month of January 1933, the area harvested amounted to 189,000 acres, a decrease of 2,000 acres or 1 per cent. as compared with the corresponding period of 1932; the area damaged was 2,000 acres a decrease of 2,000 acres or 50 per cent. as compared with January 1932, and additional plantings awaiting harvesting amounted to 5,114,060 acres a decrease of 257,940 acres or 5 per cent. The total acreage at the end of January 1933, amounted to 5,305,000 acres, a decrease of 262,000 acres or

* Abridged from the Rice Summary of February 1933, compiled by the Department of Statistics, S.S. and F.M.S.

5 per cent. as compared with the same month in 1932.

Imports of rice into Java and Madura during January 1933, totalled 17,152 tons, an increase of 1,239 tons or 8 per cent. as compared with the same month in 1932.

Imports of rice into the Outer Provinces during the period January to December 1932, amounted to 273,347 tons, a decrease of 48,509 tons or 15 per cent. as compared with the same period of 1931.

French Indo-China.—Entries of padi at the port of Cholon during January and February 1933, amounted to 192,000 (metric) tons, an increase of 2,000 tons or 1 per cent. as compared with the same months in 1932.

Export of rice from Saigon for the period January to February 1933, totalled 188,000 tons, the same figure as that shown for the corresponding period of 1932.

Ceylon.—Imports for the month of January 1933, totalled 36,412 tons, a decrease of 6,774 tons or 16 per cent. on the imports for January 1932.

Of these imports 23 per cent. were from British India, 67 per cent. from Burma and 10 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

(*a*) To Europe for the January 1st February 23rd, 1933, 145,146 tons, an increase of 74,042 tons or 104 per cent. as compared with the same period of 1932. Of these shipments 28 per cent. were from Burma, 11 per cent. from Japan, 53 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal, as compared with 60 per cent. from Burma, nil from Japan, 35 per cent. from Saigon, 3 per cent. from Siam and 2 per cent. from Bengal in 1932.

(*b*) To the Levant, period January 1st to January 25th 1933, 86 tons as compared with 5,680 tons in the same period of 1932.

(*c*) To America and the West Indies for the period January 1st to January 25th; nil as compared with 13,140 tons in the same period of 1932.

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING FEBRUARY, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FEDERATED MALAY STATES :—							
Perak	250,951	13,753	5.5	31,937	12.7	45,690	18.2
Selangor	308,379	17,997	5.8	39,854	12.9	57,851	18.8
Negri Sembilan	228,541	19,638	8.6	21,909	9.6	41,547	18.2
Pahang	38,141	9,623	25.2	3,926	10.3	13,549	35.5
Total F.M.S. ...	826,012	61,011	7.4	97,626	11.8	158,637	19.2
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,019	4.5	9,301	20.8	11,320	25.3
Dindings	6,969	404	5.8	959	13.8	1,363	19.6
Malacca	111,780	5,948	5.3	22,689	20.3	28,637	25.6
Penang Island	1,635	1,278	78.2	50	3.1	1,328	81.2
Singapore Island	28,269	13,523	47.8	3,698	13.1	17,221	60.9
Total S.S. ...	193,387	23,172	12.0	36,697	19.0	59,869	31.0
UNFEDERATED MALAY STATES :—							
Johore	325,747	43,469	13.3	33,358	10.2	76,827	23.6
Kedah (*a*) (*c*)	107,857	9,304	8.6	8,202	7.6	17,506	16.2
Kelantan	21,175	11,063	52.2	1,452	6.9	12,515	59.1
Trengganu (*b*)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (*c*)	957	106	11.1	502	52.5	608	63.5
Total U.M.S. ...	460,088	63,942	13.9	45,586	9.9	109,528	23.8
TOTAL MALAYA ...	1,479,487	148,125	10.0	179,909	12.2	328,034	22.2

Notes :— (*a*) Registered companies only and are rendered quarterly.
(*b*) Registered companies only.
The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in March 1933.

MALAYAN AGRICULTURAL EXPORTS, JANUARY, 1933.

PRODUCT	Net Export in Tons		
	Year 1932	January 1932	January 1933
Arecanuts ...	20,280	3,073	2,407
Coconuts, fresh ...	108,123*	6,559*	7,015*
Coconut oil ...	11,932	959	1,618
Copra ...	97,464	5,494	14,584
Gambier, all kinds ...	1,925	246	181
Palm kernels ...	1,248	45	65
Palm oil ...	7,892	392	405
Pineapples, canned ...	66,261	5,623	4,713
Rubber ...	417,137	41,952	35,822
Sago,—flour ...	10,267	1,178	656
„ —pearl ...	3,228	254	129
„ —raw ...	4,148†	243†	495†
Tapioca,—flake ...	9,028	534	940
„ —flour ...	392	22	315
„ —pearl ...	19,977	1,325	1,056
Tuba root ...	165½	5†	4

* hundreds in number. † net imports.

MALAYAN AGRICULTURAL EXPORTS, FEBRUARY, 1933.

PRODUCT.	Net Exports in Tons.				
	Year 1932	Jan.-Feb. 1932	Jan.-Feb 1933	February 1932	February 1933
Arecanuts ...	20,280	4,400	4,533	1,367	2,126
Coconuts, fresh ...	108,123†	13,217†	16,154	6,658†	9,139†
Coconut oil ...	11,932	1,711	2,960	752	1,342
Copra ...	97,464	13,053	18,991	7,559	4,407
Gambier, all kinds ...	1,925	503	394	255	213
Palm kernels ...	1,248	170	199	125	134
Palm oil ...	7,892	821	562	429	157
Pineapples, canned ...	66,291	11,936	9,025	6,313	4,312
Rubber ...	417,137	74,983	67,388	32,972	31,559
Sago,—flour ...	10,267	3,028	1,369	1,850	713
„ —pearl ...	3,228	451	348	197	219
„ —raw ...	4,148*	578*	767*	335*	272*
Tapioca,—flake ...	9,028	1,326	1,915	792	965
„ —flour ...	392	87	364	65	49
„ —pearl ...	19,977	2,444	2,418	1,212	1,362
Tuba root ...	165½	12	43	7	39

† hundreds in number. * net imports.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January 1933		during the month		January 1933				
	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1933	during the month	January and Feb. 1933	Foreign	From Malay States Labuan	Foreign	From Malay States Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over 19
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MALAY STATES :—																		
Federated Malay States	...	13,980	13,052	10,975	22,501	6,232	14,412	Nil	Nil	Nil	Nil	12,140	6,358	26,815	12,325	...	12,594	13,123
Johore	...	2,433	3,133	3,609	6,749	3,787	7,958	Nil	2	Nil	5	928	5,881	1,873	12,686	...	2,662	3,493
Kedah	...	730	2,596	2,050	4,681	956	2,254	Nil	Nil	Nil	Nil	1,189	2,394	2,284	5,277	...	616	2,133
Perlis	...	32	21	8	18	5	23	Nil	Nil	Nil	Nil	Nil	20	Nil	40	...	28	18
Kelantan ...	...	97	137	159	286	197	393	Nil	Nil	Nil	Nil	40	297	130	577	...	81	172
Trengganu ...	...	55	50	69	156	34	78	Nil	Nil	Nil	Nil	Nil	103	Nil	234	...	55	50
Total Malay States	...	17,327	18,989	16,870	34,391	11,211	25,118	Nil	2	Nil	5	14,297	15,053	31,102	31,139	...	16,036	18,989
STRAITS SETTLEMENTS :-																		
Malacca ...	...	6,494	1,513	1,210	2,579	1,592	3,791	Nil	15,083	9	31,204	3,686	Nil	7,618	Nil	...	6,378	1,433
Province Wellesley	...	1,057	704	441	1,0 6			Nil		Nil						...	1,087	555
Dindings ...	...	26	120	91	192			Nil		Nil		6,545		14,354		...	28	97
Penang	1,538	5,334	10	1	3			456		996						1,414	4,489	8
Singapore ...	4,473	16,824	181	143	278			4,372		9,980		13,036		31,089		4,318	16,640	196
Total Straits Settlements	6,011	29,735	2,528	1,886	4,088	1,592	3,791	4,828	15,083	10,985	31,204	23,267	Nil	53,061	Nil	5,732	28,622	2,289
TOTAL MALAYA	6,011	47,062	21,517	18,756	38,479	12,803	28,909	4,828	15,085	10,985	31,209	37,564	15,053	84,163	31,139	5,732	44,658	21,278

TABLE II
DEALERS' STOCKS, IN DRY TONS 7

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	9,692	15,079	4,032	7,278	1,024	37,105
WET RUBBER	3,902	1,561	457	215	1,638	6,773
TOTAL ...	12,594	16,640	4,489	7,493	2,662	43,878

TABLE III
FOREIGN EXPORTS 4

PORTS	For month	January 1933
Singapore ...	22,023	49,163
Penang ...	9,518	21,034
Port Swettenham.	5,230	12,483
Malacca ...	793	1,483
MALAYA ...	37,564	84,163

TABLE IV
DOMESTIC EXPORTS 8

AREA	For month	January 1933
Malay States ... / Straits Settlements	32,072	71,695
MALAYA ...	32,072	71,695

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25 ; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st of February 1933.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1933.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	92.1	71.1	81.6	95	69	89	73	83.8	84.4	13.54	343.9	3.93	16	12	5	10		206.50	7.37	61
Bukit Jeram, Selangor ...	88.6	71.8	80.2	91	70	86	74	85.2	86.4	5.42	137.7	2.97	10	7	1			240.80	8.60	72
Sitiawan, Perak ...	90.6	71.6	81.0	93	69	87	75	84.5	84.6	3.64	92.5	1.43	9	7	2	2		241.25	8.62	72
Kroh, Perak ...	90.6	65.7	78.1	93	62	83	71	81.0	81.0	1.26	32.0	0.89	6	4		1		251.20	8.97	75
Temerloh, Pahang ...	88.5	70.1	79.3	92	66	85	73	83.9	84.3	1.26	32.0	1.04	4	3				226.05	8.07	67
Kuala Lipis, Pahang ...	88.6	69.6	79.1	91	65	85	74	82.7	82.9	2.23	56.7	0.80	9	7		15		211.30	7.55	63
Kuala Pahang, Pahang ...	84.3	73.1	78.1	87	67	82	78	84.4	83.9	2.31	58.7	1.07	6	5				243.65	8.70	73
Mount Faber, Singapore ...	88.5	71.0	79.7	92	69	78	74	81.2	82.0	1.92	48.8	0.53	7	7	1			206.20	7.36	61
Butterworth, Province Wellesley ...	88.4	71.6	80.0	90	69	86	75	84.4	84.8	6.30	160.0	3.48	10	9	1			265.25	9.47	79
Bukit China, Malacca ...	89.3	72.6	80.9	92	69	82	75	84.2	83.9	0.96	24.4	0.25	8	6	3			240.85	8.60	71
Kluang, Johore ...	87.7	70.3	79.0	91	66	84	73	79.8	80.6	2.67	68.3	1.45	6	6	1	3		231.20	8.26	68
Bukit Lalang, Mersing, Johore	82.3	71.4	76.9	85	66	80	77	79.2	79.6	1.60	40.7	0.53	10	6				240.70	8.60	71
Alor Star, Kedah ...	92.6	68.8	80.6	97	65	87	73	83.1	84.0	0.33	8.4	0.31	2	1	2	1		260.90	9.32	78
Kota Bahru, Kelantan ...	85.2	68.5	76.9	87	65	81	75	80.1	81.8	3.75	95.3	2.45	4	4				249.65	8.92	75
Kuala Trengganu, Trengganu	83.8	68.9	76.3	87	66	78	75	80.4	81.4	3.79	96.3	2.74	5	4				255.80	9.14	76
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	72.9	60.2	66.4	76	56	69	63	71.0	71.5	3.67	93.2	0.92	10	7	1	12		185.30	6.62	55
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.1	52.1	62.6	76	47	71	62	67.3	68.1	2.67	67.8	0.82	13	8			1	163.10	5.83	49
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.3	57.5	65.4	78	53	69	60			2.53	64.3	0.63	12	8			1	184.75	6.60	55

Compiled from Returns supplied by the Meteorological Branch, Malaya.